Temperature Indicator with Alarm Operation Guide

Masibus Automation and Instrumentation (P) Ltd.
B/30, GIDC Electronics Estate,
Sector-25, Gandhinagar-382044, Gujarat, India.
Phone : +91-79-23287275/79.
Fax : +91-79-23287281.
E-mail : sales@masibus.com
Web : www.masibus.com

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Foreword

Thank you for purchasing 59A series Process Indicator. This manual describes the basic functions and operation methods of 59A.Please read through this user's manual carefully before using the product.

Notice

The contents of this manual are subject to change without notice as a result of continuing improvements to the instrument's performance and functions.

Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention, however, please inform MASIBUS Sales office or sales representative.

Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without our permission.

Trademarks

Our product names or brand names mentioned in this manual are the trademarks or registered trademarks of Masibus Automation and Instrumentation (P) Ltd. (herein after referred to as MASIBUS).

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Revision

2nd Edition: MARCH 2009.

Safety Precaution

The following symbols are used in the product and user's manuals to indicate safety precautions

"Handle With Care" (This symbol is attached to the part(s) of the product to indicate that the user's manual should be referred to in order to protect the operator and the instrument from harm.)

Protective grounding terminal.

Functional grounding terminal (Do not use this terminal as a protective grounding terminal.)

Alternating Current.

Direct Current.

In order to protect the system controlled by this product and the product itself, and to ensure safe operation, observe the safety precautions described in this user's manual. Use of the instrument in a manner not prescribed herein may compromise the product's functions and the protection features inherent in the device. We assume no liability for safety, or responsibility for the product's quality, performance or functionality should users fail to observe these instructions when operating the product.

Be sure to use the spare parts approved by MASIBUS when replacing parts or consumables.

This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities,

aviation facilities, and medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.

Modification of the product is strictly prohibited.

WARNING

Power Supply

Ensure that the instrument's supply voltage matches the voltage of the power supply before turning ON the power.

Do Not Use in an Explosive Atmosphere

Do not operate the instrument in locations with combustible or explosive gases or steam. Operation in such environments constitutes an extreme safety hazard. Use of the instrument in environments with high concentrations of corrosive gas (H_2S, Sox, etc.) for extended periods of time may cause a failure.

Do Not Remove Internal Unit

The internal unit should not be removed by anyone other than MASIBUS's service personnel.

External Connection

Ensure that protective grounding is connected before connecting the instrument to the device under measurement or to an external control circuit.

Damage to the Protective Construction

Operation of the instrument in a manner not specified in this user's manual may damage its protective construction.

Warning and Disclaimer

MASIBUS makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.

The product is provided on an "as is" basis. MASIBUS assumes no liability to any person or entity for any loss or damage, direct or indirect, arising from the use of the product or from any unpredictable defect of the product.

Handling Precautions for the Main Unit

The instrument comprises many plastic components. To clean it, wipe it with a soft, dry cloth. Do not use organic solvents such as benzene or thinner for cleaning, as discoloration or deformation may result.

Keep electrically charged objects away from the signal terminals. Not doing so may cause the instrument to fail.

Do not apply volatile chemicals to the display area, operation keys, etc. Do not leave the instrument in contact with rubber or PVC products for extended periods. Doing so may result in failure.

If the equipment emits smoke or abnormal smells or makes unusual noises, turn OFF the instrument's power switch immediately and unplug the device. In such an event, contact your sales representative.

Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from that which you have ordered, if any parts or accessories are missing, or if the product appears to be damaged, contact your sales representative.

Model and Suffix code

The 59A main unit has a nameplate affixed to the top of the terminals. Check the model and suffix codes inscribed on the nameplate to confirm that the product received is that which was ordered.

Model	Retransmission o/p	
409	X	
	1	4 – 20 mA
	2	0 – 20 mA
	3	1 – 5 VDC
	4	0 – 5 V DC
	5	0 – 10V DC

Table 1

Accessories

The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

No	Item name	Part number	Qty	Remarks

Table 2

Symbols Used in This Manual

This symbol is used on the instrument. It indicates the possibility of injury to the user or damage to the instrument, and signifies that the user must refer to the user's manual for special instructions. The same symbol is used in the user's manual on pages that the user needs to refer to, together with the term "WARNING" or "CAUTION."

WARNING

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and indicates precautions that should be taken to prevent such occurrences.

Technical details

1. Display
PV: Red LED 5-digit, character size 0.56".
LED for status indication (Alarm and Tx/Rx)
Operation keys: Escape, Enter, Increment, Decrement.

2. Input
Refer following Table 3.

Input	Type	Range	Accuracy
TC	E	-200.0 to 1000.0 ºC	±0.1 % Of Full span ± 1 digit
	J	-200.0 to 1200.0 ºC	
	K	-200.0 to 1350.0 ºC	
	T	-200.0 to 400.0 ºC	
	B	450.0 to 1800.0 ºC	
	R	0.0 to 1750.0 ºC	
	S	0.0 to 1750.0 ºC	
RTD	Pt 100	-200.0 to 850.0 ºC	
DC Current	4-20 mA	-19999 to 19999, -1999.9 to 1999.9, -199.99 to 199.99, -19.999 to 19.999 -1.9999 to 1.9999	
	0-20 mA		
DC Voltage	0-5 V		
	1-5 V		
	0-2 V		
	0.4 – 2V		
	± 10V		
	0-10 V		
	-10-20mV		
	± 75 mV		
	0-75 mV		
Resistance Input	0-400Ω		
	0-6000Ω		

Table 3.

* For DC Current input, 250Ω shunt resistor (sold separately) must be externally installed.
For DC current and voltage input, scaling is possible and decimal point can be changed.
Burn out current : 0.5 uA
Reference Junction compensation error: ±2 ºC
Noise Rejection Ratio
Common mode: >100 dB (50Hz)
Normal mode : >40 dB (50Hz)
RTD : Allowable lead wire resistance 15 Ω or less.

Input Impedance: **1M Ω** (Approx.) for TC, RTD, 0-2V,0.4-2V,0-75mV, ±75mV,0-400 Ω .
220 kΩ for 0-10V, ±10V
440 kΩ for 0-5V, 1-5V, 0-6000 Ω.
TEMPCO :< 100 ppm for input to display
<150 ppm for retransmission output.
3. Input Sampling period: 4 Sample/Sec

4. Alarm
Alarm AL1 - Momentary Alarm
Condition – high/low/vlow
Lamp – on/flash/latch
Relay – on/off

Alarm AL2 - Momentary Alarm
Condition – vhigh/high/low
Lamp – on/flash/latch
Relay – on/off
Note: The possible combinations are explained in the operational manual.

5. Re transmission output
DC Current: 0 to 20 mA DC, 4 to 20 mA
DC Voltage: 0 to 10 V DC, 0 to 5V DC, 1 to 5V DC.
Accuracy ±0.25% of full Span (one at a time factory settable).
Load Resistance for current O/P: 600 Ω or less
Load Resistance for Voltage O/P: 2 KΩ or more

6. Supply voltage 85 to 265V AC, 50Hz.
18 to 32 V DC .
(one at a time factory settable).

7. Power Consumption Max. 10VA

8. Insulation resistance Between Power supply terminal and ground terminal, 500V DC 50 MΩ.

9. Environment
Ambient: 0 to 55 ºC.
Humidity: 20 to 95% RH (Non-condensing).

96(W)*48(H)*112(D).
Panel Cutout: 92(W)*46(H)

10. Case
Material: ABS Plastic.
Color: Black.

11. Mounting method Panel mounting.
12. Dimension

13. Weight 260 grams (Approx.)

14. Communication

Communication Interface	Based on EIA RS-485.
Communication method	Half-duplex communication start stop synchronous.
Communication Speed	4800/9600/19200/38400bps selectable by key.
Parity	None.
Communication Protocol	Modbus RTU.
Connectable number of unit	Max.32 unit per host computer.
Communication error detection	CRC check

Table 4.

15. Contact Input

1-Channel (Isolated) Non- voltage contact input, Maximum reverse voltage 6V,Maximum Forward voltage 50V, Capacity 24V DC, 10mA

16. Transmitter Power Supply

24V DC ±10% @26mA (±10 % accuracy)

17. Isolation specification:
Measured input terminal - Isolated from other input/output terminals.
24V DC supply for transmitter - Isolated from other input/output terminal and internal circuit.
Retransmission output terminal - Isolated from other input/output terminal and internal circuit
Relay contact output terminal/RS-485 communication terminal/Power supply terminal/Ground terminal - Isolated from other input/output terminal and internal circuit.

Basic Operation

1. Overview of Display Switching and Operation keys

Keyboard and Operation

There are four keys for operation of the instruments. For understanding the operation first of all understand the functionality of keys as shown in Fig.1.

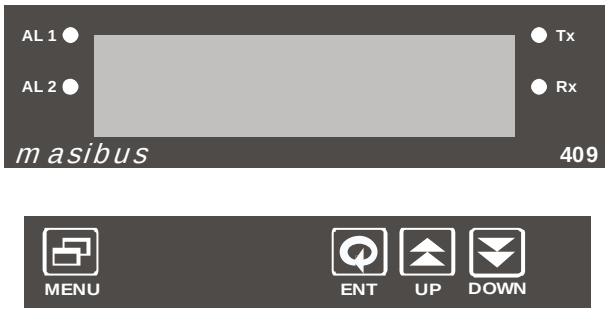


Fig.1.

MENU key **:** It is used to come out from the main or sub menu.

ENTER key **:** It is used to select the desired parameter in various operating mode. After setting the data to proper value, by increment or decrement key, it is used to enter the value of the selected parameter in memory.

UP key **:** It is used to increment the parameter for selection. Value of parameter can be incremented by pressing this key. If the key is pressed continuously for more than 10 counts change, the rate of increment will be made faster. This facility is to allow faster data change for higher values.

DOWN key **:** It is used to decrement the parameter for selection. Value of parameter can be decremented by pressing this key. If the key is pressed continuously for more than 10 counts change, the rate of decrement will be made faster. This facility is to allow faster data change for higher values. User presses during RUN mode for Thermocouple input it shows ambient value.

1.2. Password

Display indicates “PASS” on display by pressing key (UP & DOWN keys simultaneously).

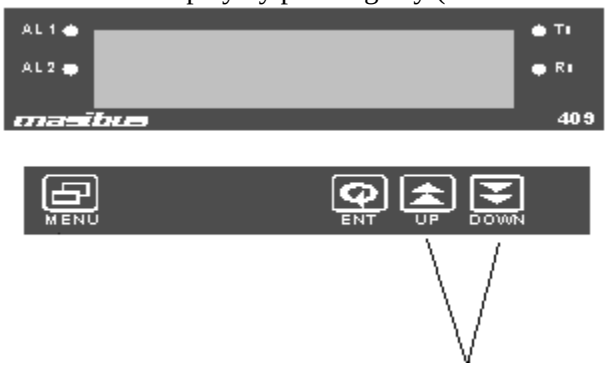


Fig.2.

This is User settable password. It can be any value between 1 to 9999. This password is to be entered each time user needs to change any parameter/value. User can set his own password as per his choice to avoid excess of the previous stored data in the instrument.

When user presses UP & DOWN keys simultaneously as shown in Fig. 2. Display shows "PASS"; press ENTER key and entered the previously stored value of password using UP, DOWN keys. The functioning of the keys is as follow.

DOWN key **:** Is used to decrement the value. Value can be decremented up to minimum value 0.
UP key **:** Is used to increment the value. Value can be incremented up to maximum value 9999.
ENTER key **:** Is used to store the set value as password.
MENU key **:** Is used to come out from the menu.

If password entered is of correct value it will display "CHANG", else it will display"FAIL". If user doesn't want to change the previously stored value of password press "MENU" key it will take the user in to main menu. Display will show "BRIhT" in the main menu. To change the values of previously stored password press ENTER key when display shows "CHANG". Display will show "0". User can increment the value of digit using UP key and decrement the digit using DOWN key. Once user set the value and presses the ENTER key display stops blinking indicates that value of password has been changed and display shows message"OK" now, again pressing MENU key user will be in the main menu. Display shows "BRIhT" that is very first menu message in main menu.

1.3. Operation in main menu

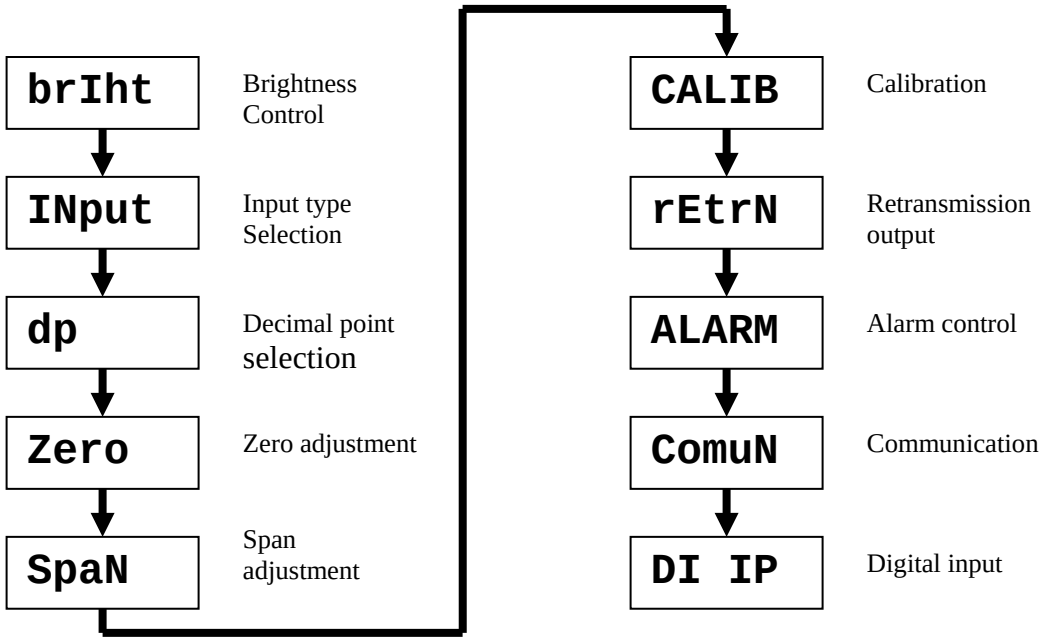


Fig. 3.

As shown in above Fig.3 by pressing UP key in incremental (from message "BRIhT") display message will be as indicated by arrow. The last message will be "DI IP" and even after user presses UP key, message will not change. Similarly from message "DI IP" by pressing DOWN key in incremental display message will be reversed from "DI IP" to "BRIhT". The last message will be "BRIhT" and even after user presses DOWN key, message will not change. To enter in to the submenu from main menu press ENTER key.

1.4. Brightness control

Brightness control is used to change the brightness of the display. Value of brightness can be varied from 0-100 in percentage. When display shows "BRIhT" press ENTER key to change brightness. Display will show value of brightness in between 0-100, user can change the value using UP/DOWN keys. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "BRIhT".

1.5. Input type selection

When display shows "INput" press ENTER key for input type selection. Display will be previously selected input value. As shown in Fig.4 by pressing UP key in incremental (from message "tC-E") display message will be as indicated by arrow. The last message will be "0-75" and even after user presses UP key, message will not change. Similarly from message "0-75" by pressing DOWN key in incremental display message will be reversed from "0-75" to "tC-E". The last message will be "TC-E" and even after user presses DOWN key, message will not change. To select specific input type press ENTER key after selecting specific input type. When user presses ENTER key display will stop flashing indicates that input type selection has been written in memory and can be recovered same input type even after power is turned off. To come out from the submenu press MENU key, display will be again "INPUT".

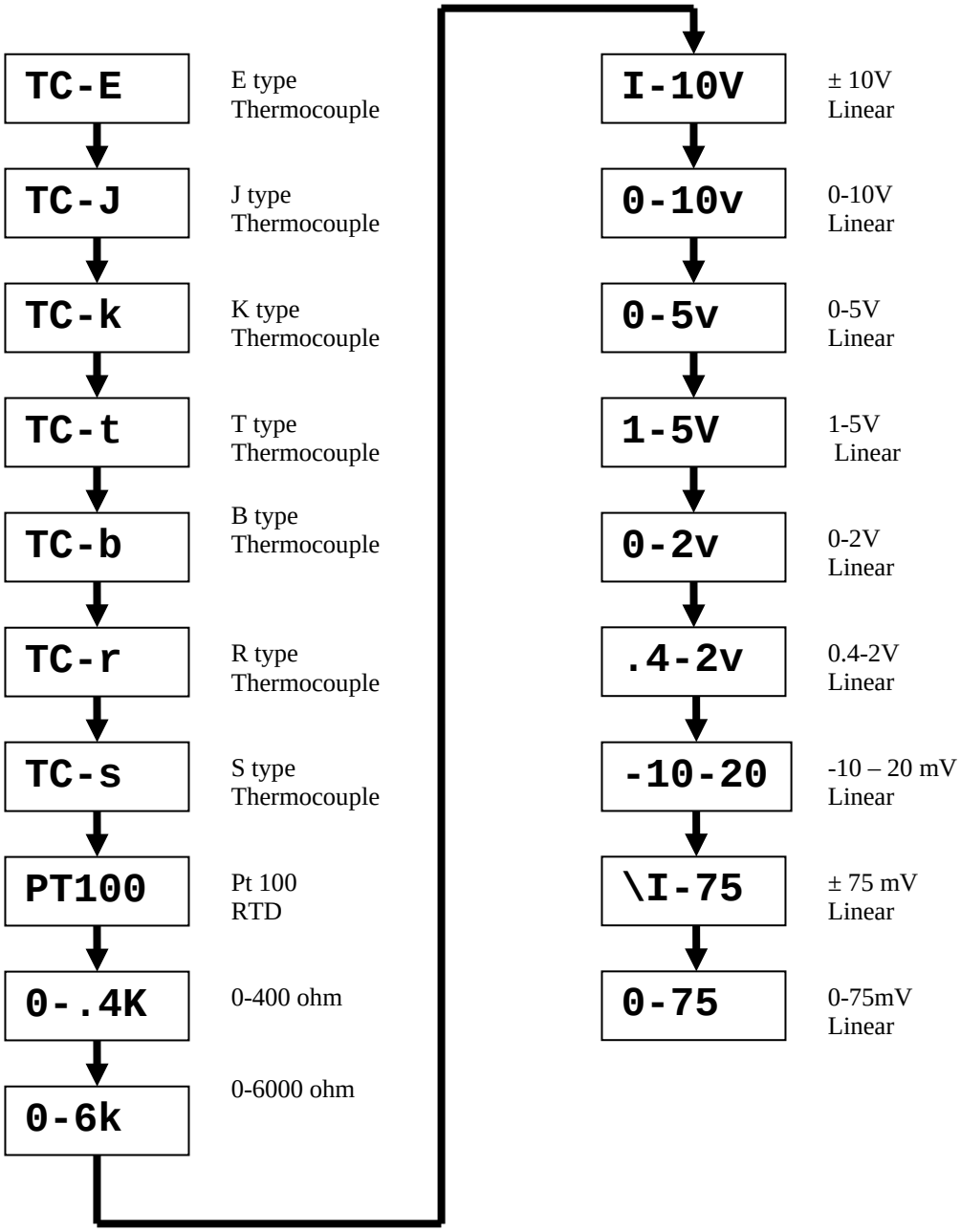

TC-E
E type Thermocouple
TC-J
J type Thermocouple
TC-k
K type Thermocouple
TC-t
T type Thermocouple
TC-b
B type Thermocouple
TC-r
R type Thermocouple
TC-s
S type Thermocouple
PT100
Pt 100 RTD
0-.4K
0-400 ohm
0-6k
0-6000 ohm
I-10V
± 10V Linear
0-10v
0-10V Linear
0-5v
0-5V Linear
1-5V
1-5V Linear
0-2v
0-2V Linear
.4-2v
0.4-2V Linear
-10-20
-10 – 20 mV Linear
\I-75
± 75 mV Linear
0-75
0-75mV Linear

Fig.4.

1.6. Decimal point

This is used to adjust the decimal point in the display specifically in linear input type. Value of decimal point can be varied from zero position (No decimal) to ten thousand positions. When display shows "Dp" press ENTER key to change decimal point. Display will show different value of decimal points as shown in following Fig.5, user can select position using UP/DOWN keys.

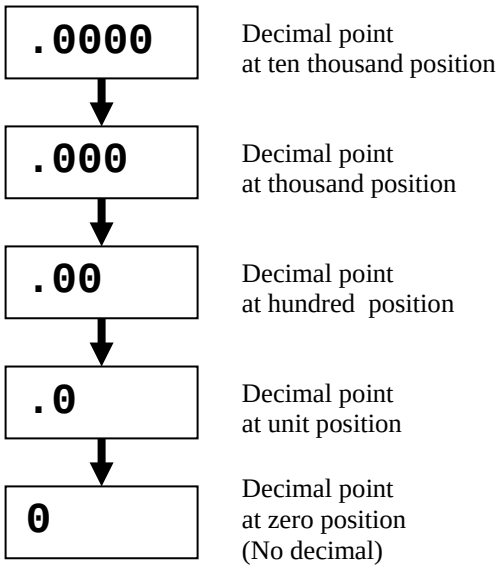


Fig.5.

As shown in above Fig.5 by pressing UP key in incremental (from message "**.0000**") display message will be as indicated by arrow. The last message will be "0" and even after user presses UP key, message will not change. Similarly from message "0" by pressing DOWN key in incremental display message will be reversed from "0" to ".0000". The last message will be ".0000" and even after user presses DOWN key, message will not change. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "Dp".

Note: This is applicable for input type other then TC and Pt 100(i.e. all linear and resistance input) for; TC and RTD input type decimal point will be fixed at unit position to give fixed 0.1 degree resolution.

1.7. Zero & Span setting

This setting is used to specify minimum and maximum range of operation and is based on the input type selected. Factory default values of zero and span setting for different input type is as shown in following table 5.

Input type	Zero	Span
TC-E	-200.0	1000.0
TC-J	-200.0	1200.0
TC-K	-200.0	1350.0
TC-T	-200.0	400.0
TC-B	450.0	1800.0
TC-R	0	1750.0
TC-S	0	1750.0
PT 100	-200.0	850.0
0-400Ω	-19999	19999
0-6000Ω	-19999	19999
±10V	-19999	19999
0-10V	-19999	19999
0 to 5V DC	-19999	19999
1 to 5V DC	-19999	19999
0 to 2V DC	-19999	19999
0.4 to 2V DC	-19999	19999
-10 to 20mV DC	-19999	19999
±75mV	-19999	19999
0-75mV	-19999	19999

Table 5.

When display shows "zero"/ "sPAN" press ENTER key to change value. Display will show value of zero/span, user can change the value using UP/DOWN keys. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "zero"/ "sPAN".

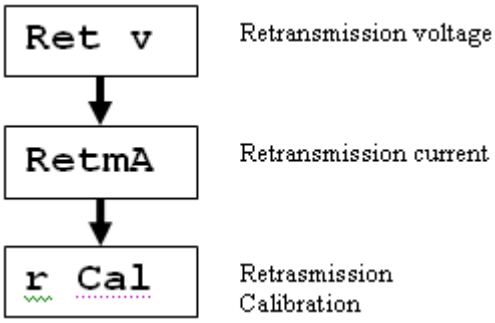
Note: User cannot enter zero value greater than span or span value less than zero in any input type.

1.8. Retransmission

Press ENTER key to enter in to the submenu of retransmission when display shows "RETRN".The submenus of "RETRN" are as shown in following Fig.6&7.

Retransmission

Fig.6



Retransmission voltage

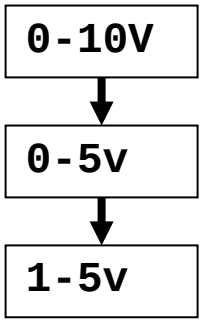
Retransmission current

Retrasmission Calibration

Fig.7

1.8.1. Retransmission voltage

Press ENTER key to enter in to the submenu of retransmission voltage when display shows "retv".The submenus of "retv" are as shown in following Fig.8.



0-10V

0-5V

1-5V

Fig.8

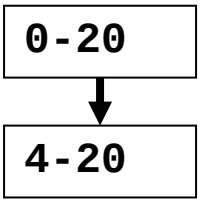
When display shows "retv" and user presses ENTER key display can be either of "0-10v","0-5v", or "1-5v" depending up on previously selected logic.

As shown in above Fig.8 by pressing UP key in incremental (from message "0-10v") display message will be as indicated by arrow. The last message will be "1-5v" and even after user presses UP key, message will not change.

Similarly from message "1-5v" by pressing DOWN key in incremental display message will be reversed from "1-5v" to "0-10v". The last message will be "0-10v" and even after user presses DOWN key, message will not change. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "retv".

1.8.2. Retransmission Current

The submenus of "retmA" are as shown in following Fig.9.



0-20

4-20

Fig.9.

When display shows "retma" and user presses ENTER key display can be either of "0-20" or "4-20" depending up on previously selected logic.If display shows "0-20" then by pressing UP key display changes to "4-20" and even after user presses UP key last display will be "4-20". Similarly, if display shows "4-20" then by pressing DOWN key display changes to "0-20" and even after user presses DOWN key last display will be "0-20". For selection of specific logic i.e. "0-20" or "4-20" press ENTER key ,display will stop flashing indicates that logic has been selected. To come out from submenus i.e. "0-20" or "4-20" press MENU key display will be "retma".

1.8.3. Retransmission calibration

Press ENTER key to enter in to the submenu of retransmission calibration when display shows "r CAL".The submenus of "r CAL" are as shown in following Fig.10.

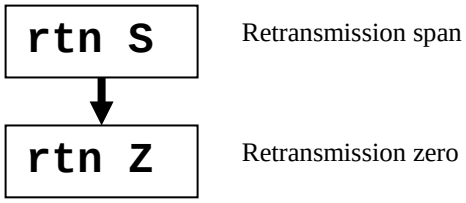


Fig.10

When display shows "rtN S"/ "rtN Z" press ENTER key to change value. Display will show value, user can change the value using UP/DOWN keys. To come out from the submenu press MENU key, display will be again "rtn S"/ "rtn Z".

Note: This is common for calibration of both voltage and current output.

1.9. Alarm

Press ENTER key to enter in to the submenu of alarm when display shows "ALARM". The submenus of "ALARM" are as shown in following Fig.11.

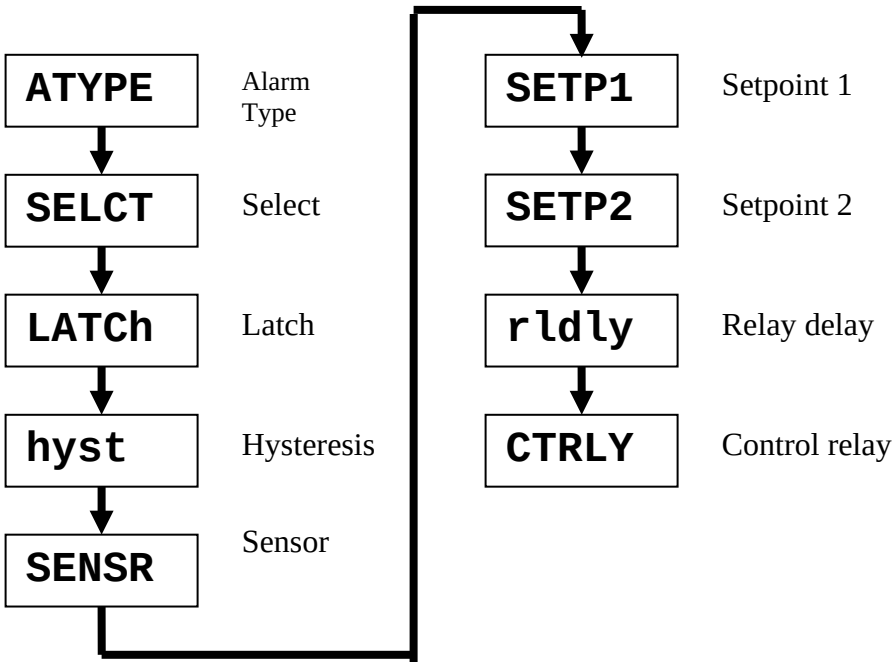


Fig.11

1.9.1. Alarm type

The submenus of "ATYPE" are as shown in following Fig.12.

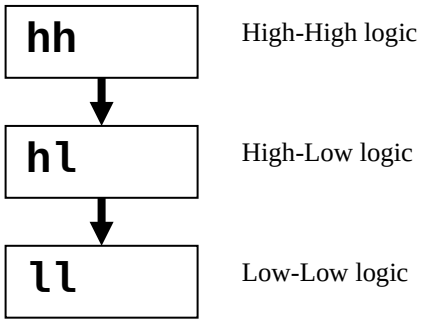


Fig.12

When display shows "ATYPE" and user presses ENTER key display can be either of "hh","hl", or "ll" depending up on previously selected logic.
As shown in above Fig.12 by pressing UP key in incremental (from message "**hh**") display message will be as indicated by arrow. The last message will be "LL" and even after user presses UP key, message will not change. Similarly from message "LL" by pressing DOWN key in incremental display message will be reversed from "ll" to "hh". The last message will be "hh" and even after user presses DOWN key, message will not change. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "ATYPE".

1.9.2. Select

The submenus of "SELCT" are as shown in following Fig.13.

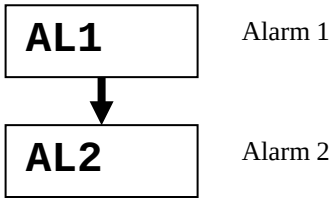


Fig.13

As shown in Fig.13 by pressing UP key in incremental (from message "AL1") display message will be as indicated by arrow. The last message will be "AL2" and even after user presses UP key, message will not change. Similarly from message "AL2" by pressing DOWN key in incremental display message will be reversed from "AL2" to "AL1". The last message will be "AL1" and even after user presses DOWN key, message will not change. To come out from the submenu press MENU key, display will be again "SELCT".
Submenus of "AL1" and "AL2" are as under. This is used to select the operation of individual relays.

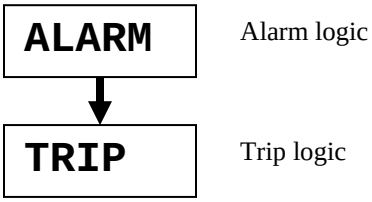


Fig.14

When display shows either "AL1" or "AL2" and user presses ENTER key display message will be either "ALARM" or "TRIP" depending up on previously selected logic.
If display shows "ALARM" then by pressing UP key display changes to "TRIP" and even after user presses UP key last display will be "TRIP". Similarly, if display shows "TRIP" then by pressing DOWN key display changes to "ALARM" and even after user presses DOWN key last display will be "ALARM". For selection of specific logic i.e. "ALARM" or "TRIP" press ENTER key ,display will stop flashing indicates that logic has been selected. To come out from submenus i.e. "ALARM" or "TRIP" press MENU key display will be "AL1" or "AL2", depending up on alarm type selected.

1.9.3. Latch
The submenus of "LatCh" are as shown in following Fig15.

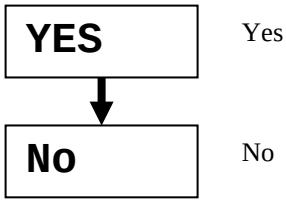


Fig.15

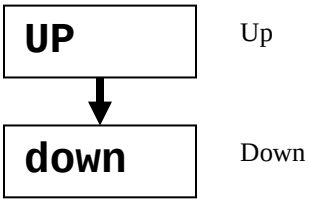


Fig.16

This indicates that whether alarm is with latch (“yes”) or without latch logic (“No”). When display shows “LATCh” and user presses ENTER key display message will be either “yes” or “No” depending up on previously selected logic.
If display shows “yes” then by pressing UP key display changes to “No” and even after user presses UP key last display will be “No”. Similarly, if display shows “No” then by pressing DOWN key display changes to “YES” and even after user presses DOWN key last display will be “YES”. For selection of specific logic i.e. “YES” or “No” press ENTER key ,display will stop flashing indicates that logic has been selected. To come out from submenus i.e. “YES” or “No” press MENU key display will be “latCh”. alarm type selected.

1.9.4. Hysteresis

Hysteresis value is common for both alarms. When display shows “hyst” press ENTER key to enter/alter the value of hysteresis.Display will show previously entered value of hysteresis .Use UP key to increase the value and DOWN key to decrease the value of hysteresis. Value of hysteresis can vary from 0(Min)-255(Max),press ENTER key to store the value in memory. Display will stop flashing when user presses ENTER key indicates that value has been stored in memory.
Press MENU key to come out from the submenu of hysteresis, display will be “hyst”.

1.9.5. Sensor

The submenus of “SENSR” are as shown in following Fig.16.

When display shows “SENSR” and user presses ENTER key display message will be either “up” or “Down” depending up on previously selected logic.
If display shows “UP” then by pressing UP key display changes to “DowN” and even after user presses UP key last display will be “DoWN”. Similarly, if display shows “DoWN” then by pressing DOWN key display changes to “up” and even after user presses DOWN key last display will be “UP”. For selection of specific logic i.e. “UP” or “DoWN” press ENTER key ,display will stop flashing indicates that logic has been selected. To come out from submenus i.e. “UP” or “DoWN” press MENU key display will be “SENSR”.

1.9.6. Set point 1/ Set point 2

When display shows “setp1” or “setp2” press ENTER key to enter/alter the value of set point. Display will show previously entered value of set point .Use UP key to increase the value and DOWN key to decrease the value of set point. Press ENTER key to store the value in memory. Display will stop flashing when user presses ENTER key indicates that value has been stored in memory.
Press MENU key to come out from the submenu of set point 1/set point2, display will be “setp1” or “setp2” depending up on selected set point .
Maximum and minimum value of set point for specific input type is as shown in following table 6.

Input type	**Minimum value**	**Maximum value**
TC-E	-200.0	1000.0
TC-J	-200.0	1200.0
TC-K	-200.0	1350.0
TC-T	-200.0	400.0
TC-B	450.0	1800.0
TC-R	0	1750.0
TC-S	0	1750.0

PT 100	-200.0	850.0
0-400Ω	-19999	19999
0-6000Ω	-19999	19999
±10V	-19999	19999
0-10V	-19999	19999
0 to 5V DC	-19999	19999
1 to 5V DC	-19999	19999
0 to 2V DC	-19999	19999
0.4 to 2V DC	-19999	19999
-10 to 20mVDC	-19999	19999
±75mV	-19999	19999
0-75mV	-19999	19999

Table.6

Note: Value of set point 1 will be always less than or equal to set point 2 or set point 2 will be always greater than or equal to set point 1.

1.9.8. Relay delay

Relay delay value is common for both alarms. When display shows "rlDly" press ENTER key to enter/alter the value of delay. Display will show previously entered value of delay .Use UP key to increase the value and DOWN key to decrease the value of delay. Value of delay can vary from 0(Min)-9999(Max) in second, press ENTER key to store the value in memory. Display will stop flashing when user presses ENTER key indicates that value has been stored in memory.
Press MENU key to come out from the submenu of delay, display will be "rlDly".

1.9.9. Control relay

The submenus of "Ctrly" are as shown in following Fig.17.

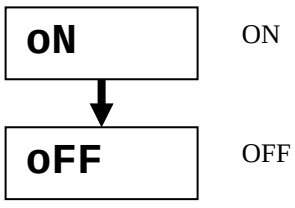


Fig.17

When display shows "Ctrly" and user presses ENTER key display message will be either "oN" or "oFF" depending up on previously selected logic.

If display shows "oN" then by pressing UP key display changes to "oFF" and even after user presses UP key last display will be "oFF". Similarly, if display shows "oFF" then by pressing DOWN key display changes to "oN" and even after user presses DOWN key last display will be "oN". For selection of specific logic i.e. "oN" or "oFF" press ENTER key ,display will stop flashing indicates that logic has been selected. To come out from submenus i.e. "oN" or "oFF" press MENU key display will be "Ctrly".

1.10. Communication

Press ENTER key to enter in to the submenu of communication when display shows "ComuN".
The submenus of "CoMUN" are as shown in following Fig.18.

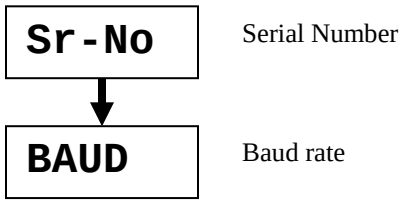


Fig.18

When display shows "CoMUN" and user presses ENTER key display message will be either "SR-No" or "BAUD".
If display shows "SR-No" then by pressing UP key display changes to "BAUD" and even after user presses UP key last display will be "BAUD". Similarly, if display shows "BAUD" then by pressing DOWN key display changes to "Sr-No" and even after user presses DOWN key last display will be "Sr-No". For selection of specific menu i.e. "Sr-No" or "BauD" press ENTER key, display will show submenu of corresponding display. To come out from submenus i.e. "Sr-No" or "BAUD" press MENU key display will be "ComuN".

1.10.1. Serial Number

This value is for slave ID /Node address selection. When display shows "SR-No" press ENTER key to enter/alter the value of serial number. Display will

show previously entered value of serial number .Use UP key to increase the value and DOWN key to decrease the value. Value of serial number can vary from 1(Min)-247(Max), press ENTER key to store the value in memory. Display will stop flashing when user presses ENTER key; it indicates that value has been stored in memory.
Press MENU key to come out from the submenu of serial no, display will be "Sr-No".

1.10.2. Baud rate

This is used to select baud rate for communication. The submenus for baud rate are as shown in following Fig.19.

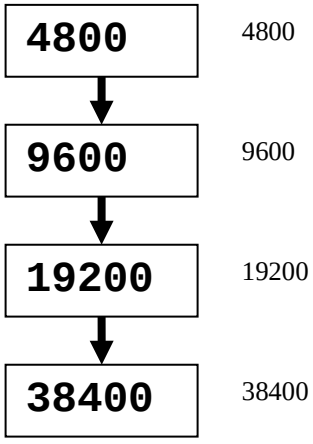


Fig.19

When display shows "BAUD" and user presses ENTER key display can be either of "4800","9600", "19200", or "38400" depending up on previously selected value.
As shown in Fig.19 by pressing UP key in incremental (from message "**4800**") display message will be as indicated by arrow. The last message will be "38400" and even after user presses UP key, message will not change. Similarly from message "38400" by pressing DOWN key in incremental display message will be reversed from "38400" to "4800". The last message will be "4800" and even after user presses DOWN key, message will not change. To store the value in memory press ENTER key, display will stop flashing. To come out from the submenu press MENU key, display will be again "BAUD".

1.11. Digital Input

Press ENTER key to enter in to the submenu of digital input when display shows "DI IP".
The submenus of "DI IP" are as shown in following Fig.20.

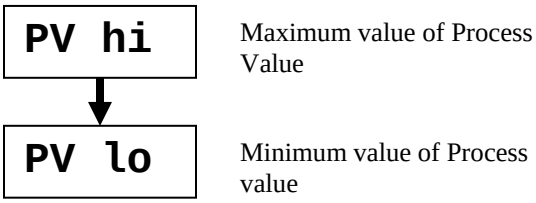


Fig.20

When display shows "DI IP" and user presses ENTER key display message will be either "PV hi" or "PV lo" depending up on previously selected.If display shows "PV hi" then by pressing UP key display changes to "PV LO" and even after user presses UP key last display will be "PV LO". Similarly, if display shows "PV LO" then by pressing DOWN key display changes to "PV HI" and even after user presses DOWN key last display will be "PV HI". For selection of specific menu i.e. "PV HI" or "PV LO" press ENTER key, display will show corresponding value of process value. To come out from submenus i.e. "PV HI" or "PV LO" press MENU key display will be "DI IP".

1.11.1. Maximum value of PV

When display shows "PV HI" press ENTER key to see the maximum process value which instrument has measured. To come out of this press MENU key display will be "PV HI".

1.11.2. Minimum Value of PV

When display shows "PV LO" press ENTER key to see the minimum process value which instrument has measured. To come out of this press MENU key display will be "PV LO".

When 24V Signal applied momentarily at the DI terminal(or Power OFF) then it will clear both values and same value will be stored in PV HI and in PV LO.Input is OPEN then message OVER will be in PV HI and UNDER will be in PV LO.Note that during power on wait until all functionality initialized otherwise PV HI/LO values will be wrong.

Calibration Procedure

1.1. Calibration for Input

The calibration in the instrument is using front panel keys only. Instrument can be calibrated even during installed condition.

Calibration is carried out using following steps.

1) Enter in to calibration mode using front panel keys. Display indicates "CalIb" in 5-segment display.

2) Press 'ENTER' key to enter in to calibration for "zero", "span" or "ambient" (for Thermocouple/RTD type input zero calibration is not require).

3) Display indicates "Calz"for zero calibration;"CALS" for span calibration and "CALA" for ambient calibration. User can enter in to zero/span/ambient calibration using UP, DOWN keys.

4) If input type selected is Thermocouple and Pt100 then there is no zero calibration hence, display will be either"CALS" or "CALA".

5) Input type other then thermocouple display will be either"CALZ" or "CALs" because for other inputs (except thermocouple) ambient calibration is not required.

6) To perform zero calibration press ENTER key when display shows "Calz". Feed input corresponding to zero and adjust the value of display using UP, DOWN keys .Once value is adjusted using UP, DOWN keys press ENTER to store that value in memory .Display will stop flashing when user presses ENTER key. Same procedure is required to perform calibration for span or ambient type.

7) Sometimes user may require iteration for zero and span calibration for better linearity/accuracy.

8) Depending upon input type selected value in the display is calibrated within limited range.

1.2. Calibration for Retransmission.

The calibration in the instrument is using front panel keys only. Instrument can be calibrated even during installed condition.

Calibration is carried out using following steps.

1) Enter in to calibration mode using front panel keys. Display indicates "RETRN" in 5-segment display.

2) Select type of output i.e.voltage or current output RET V or RET I then and then it will allow you to enter for calibration of zero and span.

3) After selecting type of output Press UP, DOWN key to get a prompt "RCAL" and press ENTER key to enter in to calibration.

3) Display indicates "RETZ"for zero calibration;"RETS" for span calibration User can enter in to zero/span calibration using UP, DOWN keys (applicable for both voltage/current output).

4) To perform zero calibration press ENTER key when display shows "RETZ".when user presses ENTER key display will be previously stored counts for voltage output/current output. Retransmission output will be nearly equal to 0 V/0mA depending up on type of selection. If output differs from 0V/0mA vary counts to get desire output.

5) Irrespective of value of count try to obtain 0V/0mA at the output and press ENTER key to store calibrated value in memory.

Repeat the above same steps for span calibration here, desired voltage output is 10V and current output is 20mA.

Note: calibration for voltage output is required to do in 0-10V range and for current output its 0-20mA range, which incorporates other ranges also. Incase of current output specially to calibrate for zero side vary count in display such that output is greater then zero mA and then bring it down by varying counts it to zero mA.

Input type	**Calibration for input**
E,J,K,T,B,R,S	Either of any input
Pt-100	Specific input
±10V,0-10V,0-5V,1-5V	Either of any input
0-2V,0.4-2V	Either of any input
±75mV,75mV	Either of any input
-10 – 20mV	Specific input
0-400Ω	Specific input
0-6000Ω	Specific input

Alarm Operation

1.1. Alarm type

HH-high, very high. AL1-high, AL2-very high
HL-high, low AL1-low, AL2-high.
LL-low, low AL1-very low, AL2-low.
This setting is common for all groups.

1.2. Status of ALARM/TRIP

It will toggle between ALARM and TRIP depending up on selection in menu. ALARM mode is further subdivided into Alarm with Latch and Alarm without Latch.

TRIP is useful when the relay is used for tripping the plant or device and it is not to be started once again. Open condition is treated as normal condition in TRIP type.

1.3. Latching of ALARM

This is used for latching of discrete LEDs and relay status when alarm limit is crossed. This option will keep discrete LEDs/Relay latched even after channel has come to normal status until ENTER (ACK) key is pressed. This option can be changed to YES or NO for enabling or disabling respectively. When configurations of Alarms are of TRIP type, these parameters will be skipped from display. The different conditions for the ALARM/TRIP have been mentioned in the following table7, 8, 9, &10.

1.4.HH Logic
HH-high, very high. AL1-high, AL2-very high

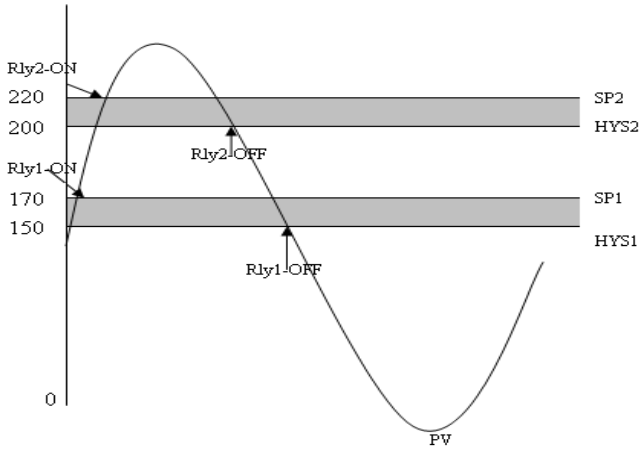


Fig.21

AL1-High, AL2-Very High
SP2>SP1

If PV>SP1 but, less then SP2 => Relay 1- ON, Relay 2-OFF.
If PV<SP1-Hyst1 => Relay 1-OFF, Relay 2-OFF.

PV>SP2 => Relay1 and Relay2 both are ON.
If PV<SP2-Hyst2 but, >SP1 => Relay 1-ON, Relay 2-OFF.

Depending up on condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table7,8,9,&10.

1.5.HL Logic
HL-high, low AL1-low, AL2- high.

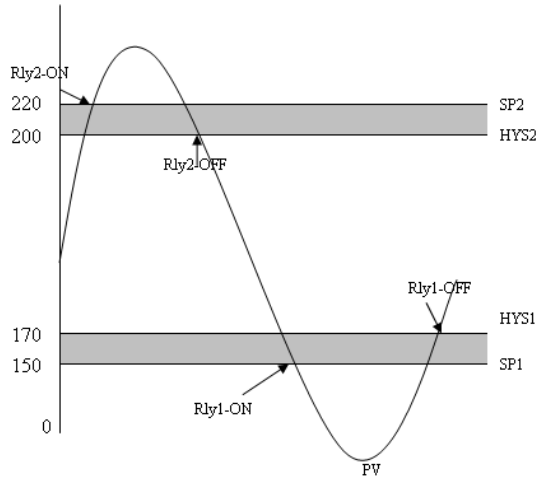


Fig.22

AL1-low, AL2- High
SP2>SP1

If PV>SP2 then Relay 2-ON.
If PV<SP2-Hyst2 => Relay 2-OFF.

PV<SP1 => Relay1 ON.
If PV>SP1+Hyst1 then. Relay 1-OFF.

Depending up on condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table7, 8, 9 & 10.

1.6.LL Logic
LL-low, low AL1-very low, AL2-low.

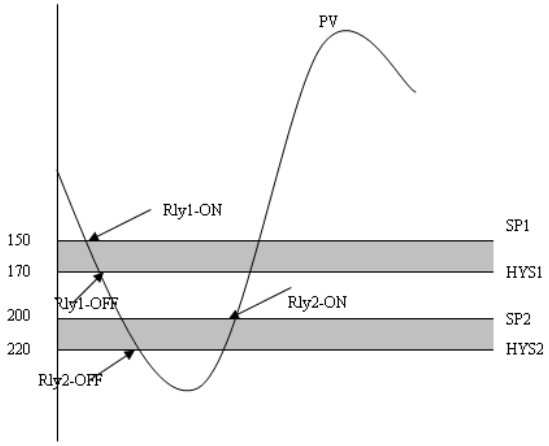


Fig.23

AL1-Low, AL2-Very Low
SP2>SP1

If PV<SP1 then => Relay 1-ON, Relay 2-ON.
Relay 1-ON till PV>SP1+HYS1 after that Relay 1-OFF.
Relay 2-ON till PV>SP2+HYS2 after that Relay 2- OFF.
Depending up on condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table7,8,9&10.

1.7. Open sensor UP scale/DOWN scale

This is used to define the state of the alarms in OPEN sensor condition. It can be configured as UP Scale or DOWN Scale by keys.

This condition works if and only if OPEN sensor condition occurs. Suppose ,UP scale has been selected and "HH" logic is there then during OPEN sensor condition Relay 1 & 2 will be ON and Lamp will be FLASH as shown in table .if DOWN logic is selected then relays and Lamp will be OFF.

HH Logic

HH-high, very high. AL1-high, AL2-very high.

In this logic if "UP Scale" condition has been selected than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the ABNORMAL condition and will work according to the following tables.
If "DOWN Scale" Condition has been selected for this logic than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the NORMAL State of operation.

HL Logic

HL-high, low AL1-low, AL2-high.

In this logic if "UP Scale" condition has been selected than in OPEN sensor condition ALARM 2 will be in the ABNORMAL condition and ALARM 1 will be in the NORMAL condition will work according to the following tables.

If "DOWN Scale" Condition has been selected for this logic than in OPEN sensor condition ALARM 1 will be in the ABNORMAL condition and ALARM 2 will be in the NORMAL condition and will work according to the following tables.

LL Logic

LL-low, low AL1-very low, AL2-low.

In this logic if "UP Scale" condition has been selected than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the NORMAL condition and will work according to the following tables.

If "DOWN Scale" Condition has been selected for this logic than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the ABNORMAL State of operation.

1.8 Relay Delay

Relay delay is the parameter used to set the delay (second) in the operation of relays (both 1&2).
Minimum value of delay is 0(second) and maximum value 9999 (second) can be configured using keyboard.

1.9. Control Relay

Control relay "OFF" then relay will function according to the condition mention in the following tables.
Control relay "ON" then functioning of relay will be just opposite to the condition mention in the table.
Lamp functioning will be as mention in the table i.e. no change in the LED status.

Alarm AL1 (Momentary Alarm): when in abnormal condition ACK not pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK ***
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF		FLASH	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF		OFF	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
Low	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH		FLASH	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH		OFF	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
VLOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH		FLASH	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH		OFF	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF

Table 7.

Alarm AL2 (Momentary Alarm): when in abnormal condition ACK not pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK ***
VHigh	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF		FLASH	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF		OFF	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF		FLASH	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF		OFF	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
LOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH		FLASH	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH		OFF	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF

Table 8

Alarm AL1 (Maintained Alarm): when in abnormal condition ACK is pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK ***
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
Low	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
VLOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF

Table 9

Alarm AL2 (Maintained Alarm): when in abnormal condition ACK is pressed.

Condition			**Normal**	**Abnormal**	**UP**	**DOWN**	**ACK****	**Normal***	**ACK *****
VHigh	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
LOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF

Table 10

Notes: *means normal condition after abnormal has occurred.
**means ACK pressed in abnormal condition.
***means ACK pressed in normal condition after abnormal has occurred.

Installation and Wiring.

1. 1.Installation Location

WARNING

1) Devices must be installed by professionally trained personnel.
2) Install devices according to NEC (National Electrical Code: ANSI/NFPA-70).

The instrument should be installed in indoor locations meeting the following conditions:

• Instrumented panel
This instrument is designed to be mounted in an instrumented panel. Mount the instrument in a location where its terminals will not inadvertently be touched.

• Well ventilated locations
Mount the instrument in well ventilated locations to prevent the instrument's internal temperature from rising. To mount multiple indicating controllers, see the external dimensions/panel cutout dimensions which follow. If mounting other instruments adjacent to the instrument, comply with these panel cutout dimensions to provide sufficient clearance between the instruments.

• Horizontal location
Mount the instrument horizontally and ensure that it is level, with no inclination to the right or left.

Note: If the instrument is moved from a location with low temperature and low humidity to a place with high temperature and high humidity, or if the temperature changes rapidly, condensation will result. Moreover, in the case of thermocouple inputs, measurement errors will result. To avoid such a situation, leave the instrument in the new environment under ambient conditions for more than 1 hour prior to using it.

Do not mount the instrument in the following locations:

• Outdoors Locations subject to direct sunlight or close to a heater
Install the instrument in a location with stable temperatures that remain close to an average temperature of 23°C. Do not mount it in locations subject to direct sunlight or close to a heater. Doing so adversely affects the internal unit.

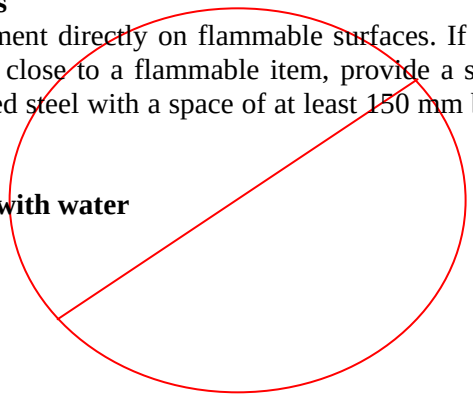
• Locations with substantial amounts of oily fumes, steam, dust, or corrosive gases
The presence of oily fumes, steam, dust, or corrosive gases adversely affects the instrument. Do not mount the instrument in locations subject to any of these substances.

• Areas near electromagnetic field generating sources
Do not place magnets or tools that generate magnetism near the instrument. If the instrument is used in locations close to a strong electromagnetic field generating source, the magnetic field may cause measurement errors.

• Locations where the display is difficult to see
Mount the instrument in a location where it can be seen as much as possible from the front.

• Areas close to flammable articles

Absolutely do not place the instrument directly on flammable surfaces. If such a circumstance is unavoidable and the instrument must be placed close to a flammable item, provide a shield for it made of 1.43 mm thick plated steel or 1.6 mm thick unplated steel with a space of at least 150 mm between it and the instrument on the top, bottom and sides.



• Areas subject to being splashed with water

1.2. Wiring

1.2.1 Wiring Precautions

1) Be sure to turn OFF the power supply before wiring to avoid an electric shock. Use a tester or similar device to ensure that no power is being supplied to a cable to be connected.

2) As a safety measure, always install a circuit breaker (an IEC 60947-compatible product, 5 A, 100 V or 220 V AC) in an easily accessible location near the instrument. Moreover, provide indication that the switch is a device for turning off the power to the instrument.

3) Wiring work must be carried out by a person with basic electrical knowledge and practical experience.

CAUTION

1) Provide electricity from a single-phase power supply. If the power is noisy, install an isolation transformer on the primary side, and use a line filter on the secondary side. When measures against noise are taken, do not install the primary and secondary power cables close to each other.

2) For thermocouple inputs, wire the thermocouple using shielded compensating lead wire. Moreover, for RTD input, use shielded wires with low conducting resistance and no resistance difference between the three wires.

3) If there is a risk of external lightning surges, use a lightning arrester, etc.

1.2.2. Cutout Dimension

Unit:mm.

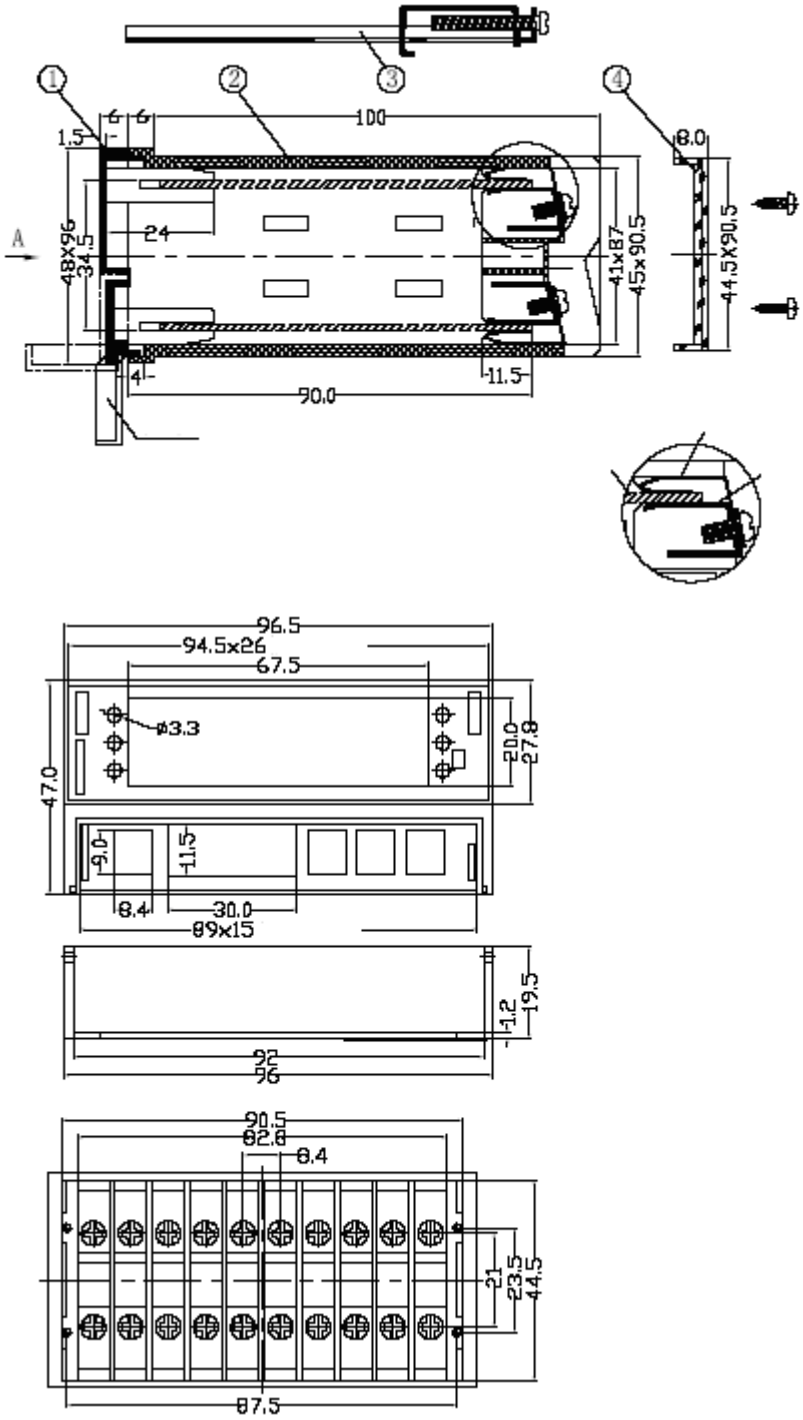


Fig.24

1.2.3. Wiring Diagram.

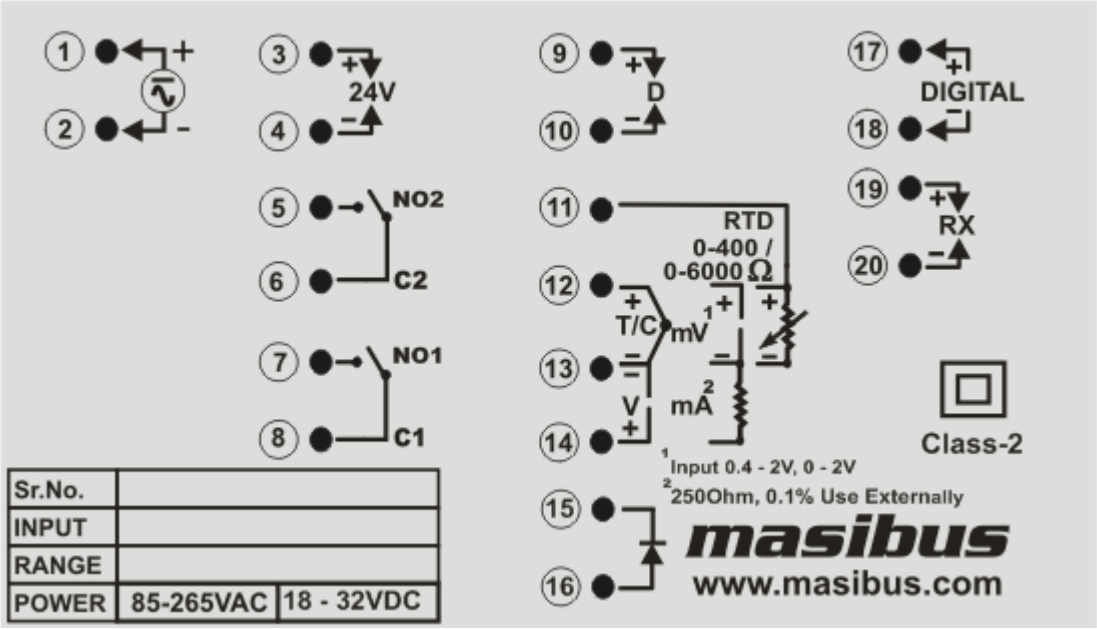


Fig.25

Parameter

1.1. Modbus Parameters.

Sr.No	Parameter	Absolute address	Type	Minimum value	Maximum Value	Access Type
1	*Relay status1	1	Bit	0	1	R/W
2	*Relay status2	2	Bit	0	1	R
3	*Alarm status1	1001	Bit	0	1	R
4	*Alarm status2	1002	Bit	0	1	R
5	Process value	30001	Integer			R
6	Zero display	40001	Integer			R/W
7	Span display	40002	Integer			R/W
8	Set point 1	40003	Integer			R/W
9	Set point 2	40004	Integer			R/W
10	Relay delay	40005	Integer	0	9999	R/W
11	Brightness	40006	Unsigned Integer	1	100	R/W
12	*Input type selected	40007	Unsigned char	0	18	R/W
13	*Decimal point	40008	Unsigned char	0	4	R/W
14	Hysteresis	40009	Unsigned char	0	255	R/W
15	Serial number	40010	Unsigned Char	1	247	R/W
16	*Baud rate	40011	Unsigned char	0	3	R/W
17	*Alarm logic type	40012	Unsigned char	0	2	R/W
18	*Alarm 1	40013	Unsigned char	0	1	R/W
19	*Alarm 2	40014	Unsigned char	0	1	R/W
20	*Alarm Latch	40015	Unsigned char	0	1	R/W
21	* Alarm sensor	40016	Unsigned char	0	1	R/W
22	*Relay control	40017	Unsigned char	0	1	R/W
23	Password	40018	Unsigned integer	1	9999	R/W

Table 11

*Relay status1, *Relay status2 it gives status of LED. Relay status1 can be used to acknowledge using function code-5.Address 3-16 for future use only.
*Alarm status1, *Alarm status2 gives status of abnormal condition only. Address 1003-1016 for future use only.
*Input type: 0 = Etc,1 = Jtc,2 = Ktc,3 = Ttc,4 = Btc,5 = Rtc,6 = Stc,7= pt-100, 8 = 0-400Ω,9 = 0-6000Ω, 10 = ±10V,11 = 0-10V,12 = 0-5V,13 = 1-5V,14 = 0-2V,15 = 0.4-2V,16 = -10-20mV,17 = ±75mV,18 = 0-75mV;*Baud rate: 0 = 4800, 1 = 9600, 2 = 19200, 3 = 38400.
Alarm Latch: 0 = YES, 1 = NO; Alarm sensor: 0 =UP, 1=DOWN.
*Relay control: 0 = ON, 1=OFF.*Alarm logic type: 0 = HH, 1 = HL, 2 = LL.
*Alarm 1: 0 = Alarm, 1 = Trip.*Alarm 2: 0 = Alarm, 1 = Trip.
Values when OPEN :– 32766, UNDER: – 32768, OVER: – 32767, doPEN: -32765.
*Decimal point: 4=0, 3= .0, 2=.00, 1=.000, 0=.0000

1.2. Menu Parameters

Parameter	Name	Setting and Display range	Unit	Factory default value	Display and setting condition for controller mode
pass	Pass word	0001 – 9999	Engg.		R/W
chaNg	Change of password	0001 – 9999	Engg	Undefined	R/W
ok	Message indicates password change correctly			Undefined	R
FAIL	Message indicates password entered is wrong.				R
BrIht	Brightness	1-100	%		R/W
INput	Input type selection				
Tc-e	Thermocouple ‘E’ type				R/W
Tc-j	Thermocouple ‘J’ type				R/W
Tc-k	Thermocouple ‘K’ type				R/W
Tc-t	Thermocouple ‘T’ type				R/W
Tc-b	Thermocouple ‘B’ type				R/W
Tc-r	Thermocouple ‘R’ type				R/W
Tc-s	Thermocouple ‘S’ type				R/W
Pt 100	RTD pt100 type				R/W
0.-4k	0-400Ω potentiometer				R/W
0-6k	0-6000Ω potentiometer				R/W
1-10v	1-10 volt DC				R/W
0-10v	0-10 volt DC				R/W
0-5v	0-5 volt DC				R/W
1-5v	1-5 volt DC				R/W
0-2v	0-2 volt DC				R/W
.4-2v	0.4-2 volt DC				R/W
-10-20	-10-20 mV DC				R/W
|1-75	± 75 mV DC				R/W
0-75	0-75 mV DC				R/W
Dp	Decimal point				
0	No decimal point.				
.0	Decimal point at unit position				
.00	Decimal point at				

	10th position				
.000	Decimal point at 100th position				
.0000	Decimal point at 1000th position				
Zero	Zero enter		Engg	Varies depending upon input type selected	R/W
SpaN	Span enter		Engg		
CalIb	Calibration				
Cals	Span calibration		Engg		R/W
Calz	Zero calibration		Engg		R/W
Cala	Ambient calibration		Engg		R/W
Alarm	Alarm Logic				
Atype	Alarm type				
hh	High-High logic				
hl	High-Low logic				
ll	Low-Low logic				
selCt	Selection for Alarm 1 & 2.				
Al1	Alarm 1				
Al2	Alarm 2				
Alarm	Alarm selection				
TrIp	Trip selection				
Latch	Latch status				
yes	Latch Yes				
No	Latch No				
hyst	Hysteresis	0-255	Engg		R/W
Sensr	Sensor logic selection				
Up	Up scale logic				
dowN	Down scale logic				
Setp1	Set point 1 for Alarm 1				R/W
Setp2	Set point 2 for Alarm 2				R/W
Rldly	Relay delay	0-9999	second		R/W
ctrly	Control relay logic				
oN	On control relay				
off	OFF control relay				
Comun	485-Communication				
Sr-No	Serial number for Modbus.	1-247	Engg		R/W
Baud	Baud rate selection				R/W
4800	4800				R/W
9600	9600				R/W
19200	19200				R/W
38400	38400				R/W
Retrn	Retransmission				
Ret v	Retransmission				

	voltage				
0-10v	Output 0-10V				
0-5v	Output 0-5V				
1-5v	Output 1-5V				
Ret mA	Retransmission current				
0-20	Output 0-20mA				
4-20	Output 4-20mA				
R cal	Retransmission calibration				
Rtn s	Retransmission span				
Rtn z	Retransmission zero				
DI Ip	Digital input				
PV hi	Maximum Process value				
PV Lo	Minimum process value				
doPEN	Sensor Diode is OPEN				

Table 12

1.3. Messages during OPEN SENSOR condition.

Input type	Message
TC-E	OPEN
TC-J	OPEN
TC-K	OPEN
TC-T	OPEN
TC-B	OPEN
TC-R	OPEN
TC-S	OPEN
PT 100	OPEN
0-400Ω	OPEN
0-6000Ω	OPEN
±10V	Random value
0-10V	OPEN
0 to 5V DC	OPEN
1 to 5V DC	OPEN
0 to 2V DC	OPEN
0.4 to 2V DC	OPEN
-10 to 20mV DC	OPEN
±75mV	OPEN
0-75mV	OPEN

Table 13

Note: If set zero/span for input type is less then maximum value of zero and span for then process value will display readings above 3% of display range, then after it will show OVER/UNDER message until value crosses maximum value of Sensor range. Process value greater then maximum value of zero/span then display will show OPEN message. Retransmission o/p will follow 3% of display range and then it will give fixed o/p depending up on OPEN sensor selection. In case of linear inputs scaling is applied then during OPEN sensor condition it may not show OPEN message instead it will show either OVER/UNDER.

If diode is OPEN in that case message on display will be “dOPEN” .Switch OFF the instrument connect the diode properly and switch ON to have proper display. During diode OPEN condition modbus gives fixed value.

1.4. Retransmission output during OPEN sensor/Diode Open condition

I/P	0-20 mA O/P		4-20 mA O/P	
	UP Scale O/P	**DW Scale O/P**	**UP Scale O/P**	**DW Scale O/P**
*TC	21.00	0.0	20.8	3.2
Pt-100	21.00	0.0	20.8	3.2
0~5V	21.00	0.0	20.8	3.2
1~5V	21.00	0.0	20.8	3.2
±75mV	21.00	0.0	20.8	3.2
0~75mV	21.00	0.0	20.8	3.2
0~10V	21.00	0.0	20.8	3.2
*±10V	Random	Random	Random	Random
0~2V	21.00	0.0	20.8	3.2
0.4~2V	21.00	0.0	20.8	3.2
-10~20mV	21.00	0.0	20.8	3.2
0~6000Ω	21.00	0.0	20.8	3.2
0~400Ω	21.00	0.0	20.8	3.2

Table 14-A

I/P	0-10 V O/P		0-5 V O/P		1-5 V O/P	
	UP Scale O/P	**DW Scale O/P**	**UP Scale O/P**	**DW Scale O/P**	**UP Scale O/P**	**DW Scale O/P**
*TC	10.50	0.0	5.25	0.0	5.20	0.80
Pt-100	10.50	0.0	5.25	0.0	5.20	0.80
0~5V	10.50	0.0	5.25	0.0	5.20	0.80
1~5V	10.50	0.0	5.25	0.0	5.20	0.80
±75mV	10.50	0.0	5.25	0.0	5.20	0.80
0~75mV	10.50	0.0	5.25	0.0	5.20	0.80
0~10V	10.50	0.0	5.25	0.0	5.20	0.80
*±10V	Random	Random	Random	Random	Random	Random
0~2V	10.50	0.0	5.25	0.0	5.20	0.80
0.4~2V	10.50	0.0	5.25	0.0	5.20	0.80
-10~20mV	10.50	0.0	5.25	0.0	5.20	0.80
0~6000Ω	10.50	0.0	5.25	0.0	5.20	0.80
0~400Ω	10.50	0.0	5.25	0.0	5.20	0.80

Table 14-B

*TC – E,J,K,T,B,R,S.
*±10V – OPEN is not displayed in this input type.
OVER, UNDER Condition is treated same as OPEN.
Above mention value in the table will come only after calibration for specific o/p type i.e. Voltage/Current.

1.5. Used Modbus function descriptions.

1.5.1 Read coil status (01).

Description : Reads the ON/OFF status of discrete outputs (0X references, coils) in the slave. Broadcast is not supported.

Query: The query message specifies the starting coil and quantity of coils to be read. Coils are addressed starting at zero: coils 1–16 are addressed as 0–15.Here is an example of a request to read coils 20–56 from slave device 17:

Example

Field Name (Hex)	
Slave Address	11
Function	01
Starting Address Hi	00
Starting Address Lo	13
No. of Points Hi	00
No. of Points Lo	25
Error Check (LRC or CRC)	—

Response: The coil status in the response message is packed as one coil per bit of the data field. Status is indicated as: 1 = ON; 0 = OFF. The LSB of the first data byte contains the coil addressed in the query. The other coils follow toward the high order end of this byte, and from ‘low order to high order’ in subsequent bytes. If the returned coil quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros (toward the high order end of the byte). The Byte Count field specifies the quantity of complete bytes of data. Here is an example of a response to the query on the opposite page:

Example

Field Name (Hex)	
Slave Address	11
Function	01
Byte Count	05
Data (Coils 27–20)	CD
Data (Coils 35–28)	6B
Data (Coils 43–36)	B2
Data (Coils 51–44)	0E
Data (Coils 56–52)	1B
Error Check (LRC or CRC)	—

The status of coils 27–20 is shown as the byte value CD hex, or binary 1100 1101. Coil 27 is the MSB of this byte, and coil 20 is the LSB. Left to right, the status of coils 27 through 20 is: ON–ON–OFF–OFF–ON–ON–OFF–ON. By convention, bits within a byte are shown with the MSB to the left, and the LSB to the right. Thus the coils in the first byte are ‘27 through 20’, from left to right. The next byte has coils ‘35 through 28’, left to right. As the bits are transmitted serially, they flow from LSB to MSB: 20 . . . 27, 28 . . . 35, and so on.
In the last data byte, the status of coils 56–52 is shown as the byte value 1B hex, or binary 0001 1011. Coil 56 is in the fourth bit position from the left, and coil 52 is the LSB of this byte. The status of coils 56 through 52 is: ON–ON–OFF–ON–ON. Note how the three remaining bits (toward the high order end) are zero–filled.

1.5.2. Read Input Status (02)

Description: Reads the ON/OFF status of discrete inputs (1X references) in the slave.
Broadcast is not supported.

Query: The query message specifies the starting input and quantity of inputs to be read. Inputs are addressed starting at zero: inputs 1–16 are addressed as 0–15.Here is an example of a request to read inputs 10197–10218 from slave device17:

Example Field Name (Hex)	
Slave Address	11
Function	02
Starting Address Hi	00
Starting Address Lo	C4
No. of Points Hi	00
No. of Points Lo	16
Error Check (LRC or CRC)	—

Response: The input status in the response message is packed as one input per bit of the data field. Status is indicated as: 1 = ON; 0 = OFF. The LSB of the first data byte contains the input addressed in the query. The other inputs follow toward the high order end of this byte, and from ‘low order to high order’ in subsequent bytes. If the returned input quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros (toward the high order end of the byte). The Byte Count field specifies the quantity of complete bytes of data.

Example

Field Name (Hex)	
Slave Address	11
Function	02
Byte Count	03
Data (Inputs 10204–10197)	AC
Data (Inputs 10212–10205)	DB
Data (Inputs 10218–10213)	35
Error Check (LRC or CRC)	—

The status of inputs 10204–10197 is shown as the byte value AC hex, or binary1010 1100. Input 10204 is the MSB of this byte, and input 10197 is the LSB.Left to right, the status of inputs 10204 through 10197 is: ON–OFF–ON–OFF–ON–ON–OFF–OFF. The status of inputs 10218–10213 is shown as the byte value 35 hex, or binary 0011 0101. Input 10218 is in the third bit position from the left, and input 10213 is the LSB. The status of inputs 10218 through 10213 is: ON–ON–OFF–ON–OFF–ON. Note how the two remaining bits (toward the high order end) are zero–filled.

1.5.3. Read Holding register (03)

Description: Reads the binary contents of holding registers (4X references) in the slave. Broadcast is not supported.

Query: The query message specifies the starting register and quantity of registers to be read. Registers are addressed starting at zero: registers 1–16 are addressed as0–15.Here is an example of a request to read registers 40108–40110 from slave device17:

Example

Field Name (Hex)	
Slave Address	11
Function	03
Starting Address Hi	00
Starting Address Lo	6B
No. of Points Hi	00
No. of Points Lo	03
Error Check (LRC or CRC)	—

Response: The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits. Data is scanned in the slave at the rate of 125 registers per scan for 984–X8Xcontrollers (984–685, etc), and at the rate of 32 registers per scan for all other controllers. The response is returned when the data is completely assembled.

Example

Field Name (Hex)	
Slave Address	11
Function	03
Byte Count	06
Data Hi (Register 40108)	02
Data Lo (Register 40108)	2B
Data Hi (Register 40109)	00
Data Lo (Register 40109)	00
Data Hi (Register 40110)	00
Data Lo (Register 40110)	64
Error Check (LRC or CRC)	—

The contents of register 40108 are shown as the two byte values of 02 2B hex, or 555 decimal. The contents of registers 40109–40110 are 00 00 and 00 64 hex, or 0 and 100 decimal.

1.5.4. Read Input register (04)

Description: Reads the binary contents of input registers (3X references) in the slave. Broadcast is not supported.

Query: The query message specifies the starting register and quantity of registers to be read. Registers are addressed starting at zero: registers 1–16 are addressed as 0–15. Here is an example of a request to read register 30009 from slave device 17:

Example

Field Name (Hex)	
Slave Address	11
Function	04
Starting Address Hi	00
Starting Address Lo	08
No. of Points Hi	00
No. of Points Lo	01
Error Check (LRC or CRC)	—

Response: The register data in the response message are packed as two bytes per register,with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the

second contains the low order bits. Data is scanned in the slave at the rate of 125 registers per scan for 984–X8X controllers (984–685, etc), and at the rate of 32 registers per scan for all other controllers. The response is returned when the data is completely assembled.

Example

Field Name (Hex)	
Slave Address	11
Function	04
Byte Count	02
Data Hi (Register 30009)	00
Data Lo (Register 30009)	0A
Error Check (LRC or CRC)	—

The contents of register 30009 are shown as the two byte values of 00 0A hex, or 10 decimal.

1.5.5 Force Single Coil (05)

Description: Forces a single coil (0X reference) to either ON or OFF. When broadcast the function forces the same coil reference in all attached slaves.

Query: The query message specifies the coil reference to be forced. Coils are addressed starting at zero: coil 1 is addressed as 0. The requested ON/OFF state is specified by a constant in the query data field. A value of FF 00 hex requests the coil to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the coil. Here is an example of a request to force coil 173 ON in slave device 17:

Example

Field Name (Hex)	
Slave Address	11
Function	05
Coil Address Hi	00
Coil Address Lo	AC
Force Data Hi	FF
Force Data Lo	00
Error Check (LRC or CRC)	—

Response: The normal response is an echo of the query, returned after the coil state has been forced.

Here is an example of a response to the query on the opposite page:

Example

Field Name (Hex)	
Slave Address	11
Function	05
Coil Address Hi	00
Coil Address Lo	AC
Force Data Hi	FF
Force Data Lo	00
Error Check (LRC or CRC)	—

1.5.6. Preset Multiple Registers (16)

Description: Presets values into a sequence of holding registers (4X references). When broadcast, the function presets the same register references in all attached slaves.

Query: The query message specifies the register references to be preset. Registers are addressed starting at zero: register 1 is addressed as 0. The requested preset values are specified in the query data field. All other controllers use 16–bit values. Data is packed as two bytes per register. Here is an example of a request to preset two registers starting at 40002 to 00 0A and 01 02 hex, in slave device 17:

Example

Field Name (Hex)	
Slave Address	11
Function	10
Starting Address Hi	00
Starting Address Lo	01
No. of Registers Hi	00
No. of Registers Lo	02
Byte Count	04
Data Hi	00
Data Lo	0A
Data Hi	01
Data Lo	02
Error Check (LRC or CRC)	—

Response The normal response returns the slave address, function code, starting address, and quantity of registers preset. Here is an example of a response to the query shown above.
Example

Field Name (Hex)	
Slave Address	11
Function	10
Starting Address Hi	00
Starting Address Lo	01
No. of Registers Hi	00
No. of Registers Lo	02
Error Check (LRC or CRC)	—

1.6. Exception responses for modbus.

The exception response message has two fields that differentiate it from a normal response:

Function Code Field: In a normal response, the slave echoes the function code of the original query in the function code field of the response. All function codes have a most–significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the slave sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response. With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.

Data Field: In a normal response, the slave may return data or statistics in the data field (any information that was requested in the query). In an exception response, the slave returns an exception code in the data field. This defines the slave condition that caused the exception.

Fig.26 shows an example of a master query and slave exception response. The field examples are shown in hexadecimal.

QUERY

Byte	Contents	Example
1	Slave Address	0A
2	Function	01
3	Starting Address Hi	04
4	Starting Address Lo	A1
5	No. of Coils Hi	00
6	No. of Coils Lo	01
7	LRC	4F

EXCEPTION RESPONSE

Byte	Contents	Example
1	Slave Address	0A
2	Function	81
3	Exception Code	02
4	LRC	73

Fig.26.

In this example, the master addresses a query to slave device 10 (0A hex). The function code (01) is for a Read Coil Status operation. It requests the status of the coil at address 1245 (04A1 hex). Note that only that one coil is to be read, as specified by the number of coils field (0001). If the coil address is non–existent in the slave device, the slave will return the exception response with the exception code shown (02). This specifies an illegal data address for the slave. For example, if the slave is a 984–385 with 512 coils,
this code would be returned.

Exception codes

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the Slave
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the Slave

Table 15

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MASIBUS AUTOMATION AND INSTRUMENTATION (P) LTD.

Headquarter:

B/30, GIDC Electronics Estate, Sector – 25,
Gandhinagar-382044, Gujarat, India.
Ph : +91-79-23287275 / 79.
Fax : +91-79-23287281.
E-mail : sales@masibus.com
Web : www.masibus.com